

ATTACHMENT 1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Muller, et al.
Appl. No.: 10/553,293
Conf. No.: 8643
Filed: July 6, 2006
Title: POLYMER NETWORKS
Art Unit: 1796
Examiner: G. Mesh
Docket No.: 91962/US

DECLARATION UNDER 37 C.F.R. § 1.132

Sir:

I, Rolf Müller, hereby state as follows:

1. My experience and qualifications are as follows:

I studied material sciences at the Swiss Federal Institute of Technology and graduated in 1989. I have 20 years of experience in my professional career working as an engineer, scientist and inventor in the field of polymers.

2. I am one of the named inventors of the above-identified patent application and am therefore familiar with the claimed invention disclosed therein. I have reviewed the final Office Action dated December 4, 2008 pending against the above-identified patent application. In addition to considering the outstanding Office Action, I have reviewed the primary references cited therein, i.e., U.S. Patent No. 6,300,398 to Jialanella et al. ("*Jialanella*") and Polywax Polyethylene ("*Baker-Hughes*") along with an Eastman publication Epolene E-20 Wax - Extrusion lubricant for Fractional Melt High-Density Polyethylene ("HDPE") ("*Eastman publication 'Epolene E-20 Wax'*"), as well as the pending claims. I believe that the obviousness rejections based on *Jialanella* and *Baker-Hughes* are incorrect and based on a misunderstanding of the cited references and the pending claims.

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3. The present claims as defined by independent Claim 13 are directed to a polymer mixture containing at least one synthetic first polymer P(i) and at least one second polymer P(j) (the "claimed polymer mixture"). The first polymer P(i) has a degree of polymerisation $DP(P(i)) > 500$ and at least one type of crystallisable sequences A having a degree of polymerisation $DPs(P(i))$ of these sequences > 20 . The second polymer P(j) is made up of the same monomer units as the sequences A of P(i) and the degree of polymerisation $DP(P(j))$ of P(j) is $20 < DP(P(j)) < 500$. The polymer mixture comprises a molecularly dispersed mixture containing P(i) and P(j) forms a network under heterocrystallisation.

4. P(i) or the sequences A of P(i) comprise a polyolefin selected from the group consisting of a polypropylene, polyethylene, VLDPE, LDPE, LLDPE, HDPE, HMWPE, UHMWPE and mixtures thereof. P(i) has a degree of branching $< 3 \times 10^{-2}$.

5. P(j) has a polydispersity < 30 . P(j) is selected from the group consisting of n-alkanes C_nH_{2n+2} ; isoalkanes C_n ; cyclic alkanes C_nH_{2n} ; polyethylene wax; paraffins and paraffin wax of mineral origin such as macrocrystalline, intermediate or microcrystalline paraffins, brittle, ductile, elastic or plastic microcrystalline paraffins; paraffins and paraffin wax of synthetic origin; hyper-branched alpha olefins; polypropylene wax and mixtures thereof. P(j) has a degree of branching $< 5 \times 10^{-2}$.

6. The claimed polymer mixture is in the form of a thermoplastic melt that is prepared by means of a dispersively and distributively acting mixing system by means of a double-screw extruder or a single screw extruder with mixing section or Buss-Ko kneader. As shown in Figures 1 – 3 of the pending application, the E-modulus, yield stress and elongation at break are best when using a twin screw- extruder (i.e., a double screw extruder). It should be noted that the single screw extruder used in these examples that results in lower E-modulus, yield stress and elongation at break is not a single screw extruder with mixing section but a conventional single screw extruder.

7. *Jialanella* is directed to polymer compositions comprising a homogeneous linear or substantially linear ethylene polymer ("interpolymer"). See *Jialanella*, column 1, lines 7-8. *Jialanella* teaches that with decreasing density the elongation properties of the interpolymers increase, which is desired, but the upper use temperature and the onset of crystallization temperature decrease, which is not desired. See *Jialanella*, column 1, lines 17-24. As a result, *Jialanella* is directed to a solution to this problem. Practically, the onset of crystallization of the interpolymers can be as low as 40°C. Even at 25°C crystallization is not completed. To complete crystallization, cooling until below 0°C would be necessary but this is not feasible because much of the crystallinity would melt again at room temperature. Thus, the low upper use temperature and the low onset of crystallization are problematic. The interpolymers can be regarded as being in a partially molten state at room temperature.

8. *Jialanella* teaches that if a higher density crystallinity material such as a higher density homogeneous ethylene polymer or a traditional wax is added to the polymer composition, the problem with the crystallinity would be compensated but at the same time a highly deleterious loss of elongation properties is obtained. See *Jialanella*, column 1, lines 25-35. Good elongational properties are exactly the reason why the interpolymers are useful. *Jialanella* clearly teaches that adding a wax leads to a break down of the elongational properties, which teaches away from the claimed polymer mixture.

9. Applicants have surprisingly found that this is not the case for the claimed polymer mixture. In Figure 3 of the specification, the elongation at break using different mixers is shown for some samples according to the claimed polymer mixture containing wax. Using a twin screw extruder, which has the best mixing performance, the elongation at break does not decrease in the range of about 0 – 15% added wax. On the other hand, if a single screw extruder or a Brabender kneeder (5 min mixing time) is used, as both are capable of only limited mixing performance, the elongation at break decreases already at minor amounts of wax. The situation can be improved a bit, if the Brabender kneeder is operated for a longer time as 15 minutes since the mixing performance gets a bit better, but nevertheless is still limited compared to a twin screw extruder where a much better mixing performance can be achieved at typical mixing times

artisan. Further, this section of *Jialanella* provides insufficient guidance because it is not clear what has to be done with this higher density polymer and it is not clear why the homogeneous interpolymers require a comonomer, as they contain already comonomers. It is also not clear why their density has to be reduced to the range from 0.9 to 0.935g/cm³ because they already have a density less than 0.910 g/cm³ by definition. See *Jialanella*, column 1, line 14. Consequently, this section of *Jialanella* is unclear and the skilled artisan would receive no guidance from it.

16. The skilled artisan would conclude that *Jialanella* probably tried to claim his highly interesting nucleating agents that can increase the elongation at break by a factor of at least four (column 2, lines 20-23) for as many polymer compositions as possible and also for mixtures that actually are beyond the scope of his polymer compositions. On the other hand, the wax in *Jialanella* is only optional and mentioned together with other possible additives like tackifiers and plasticizers.

17. As understood by the skilled artisan, the interpolymers described by *Jialanella* are not suitable for e.g. injection molding applications that may be used to prepare castings as recited by Claim 49. Injection molding typically requires harder materials. Furthermore, the skilled artisan would not injection mold coatings and adhesives because such materials require other techniques of application. The low onset of crystallization that is typical for the interpolymers described by *Jialanella* makes it economically unreasonable to process such interpolymers by injection molding where a fast crystallization is essential and parallels a high onset of crystallization.

18. Based on the previous discussion, the skilled artisan would understand *Jialanella* to be non-analogous art. The skilled artisan interested in improving polymers and polymer mixtures with improved processability and with maintained or improved mechanical properties suitable for e.g. injection molding processes would not try to find solutions in studying polymers used for adhesives and coatings as taught by *Jialanella*. The skilled artisan reading *Jialanella* would be taught to either combine wax with a suitable nucleating agent or then to avoid wax for

agent. See *Jialanella*, column 1, lines 60-64. From this, the skilled artisan would understand that by adding wax the upper use temperature and the onset of crystallization temperature can be improved towards higher values and that the deleterious negative effect of the wax on elongational properties can be overcome by simultaneously using an appropriate amount of nucleating agent. As a result, this would confirm the skilled artisan's understanding that wax as a short chain molecule has an adverse effect on elongational properties as it is clear that the good elongational properties of polymers are a direct consequence of the unique feature of polymers: the long chain. The fact that the nucleating agent increases the elongation at break by a factor of at least four, as is pointed out in column 2, lines 20-23, is very surprising indeed and comprises the essential teaching of *Jialanella*.

13. The skilled artisan would not conclude from the use of soft coatings and hot melt adhesives containing wax and nucleating agent (as taught by *Jialanella*) that adding a wax to achieve a higher density, rigid polymer would obtain articles with maintained or improved properties. Instead, the skilled artisan would expect a break down of the properties of the polymer, particularly of the elongational properties.

14. Interpolymers according to *Jialanella* have densities in g/cm^3 less than 0.910, most preferably less than 0.880. See *Jialanella*, column 1, lines 14-16. All the examples of such interpolymers in *Jialanella* have densities in the range 0.86 – 0.89 g/cm^3 . See *Jialanella*, Table 1. The skilled artisan understands these interpolymers as very soft materials having E-moduli in the range of typically 5 MPa while a typical LDPE has an E-modulus of 400 MPa and a typical HDPE has an E-modulus of about 700 MPa. Typical applications of such polymers compositions are in the field of high speed coatings (of fabrics, carpet backing, floor tile, and sheeting) and hot melt adhesives. See *Jialanella*, abstract.

15. Although *Jiallanella* discloses an ethylene homopolymer having a density from 0.9 to 0.935 g/cm^3 , according to the introduction, a higher density polymer leads to highly deleterious loss of elongational properties. See *Jialanella*, column 3, lines 25-33. As a result, *Jialanella* appears to be contradictory, which does not provide any guidance to the skilled

artisan. Further, this section of *Jialanella* provides insufficient guidance because it is not clear what has to be done with this higher density polymer and it is not clear why the homogeneous interpolymers require a comonomer, as they contain already comonomers. It is also not clear why their density has to be reduced to the range from 0.9 to 0.935g/cm³ because they already have a density less than 0.910 g/cm³ by definition. See *Jialanella*, column 1, line 14. Consequently, this section of *Jialanella* is unclear and the skilled artisan would receive no guidance from it.

16. The skilled artisan would conclude that *Jialanella* probably tried to claim his highly interesting nucleating agents that can increase the elongation at break by a factor of at least four (column 2, lines 20-23) for as many polymer compositions as possible and also for mixtures that actually are beyond the scope of his polymer compositions. On the other hand, the wax in *Jialanella* is only optional and mentioned together with other possible additives like tackifiers and plasticizers.

17. As understood by the skilled artisan, the interpolymers described by *Jialanella* are not suitable for e.g. injection molding applications that may be used to prepare castings as recited by Claim 49. Injection molding typically requires harder materials. Furthermore, the skilled artisan would not injection mold coatings and adhesives because such materials require other techniques of application. The low onset of crystallization that is typical for the interpolymers described by *Jialanella* makes it economically unreasonable to process such interpolymers by injection molding where a fast crystallization is essential and parallels a high onset of crystallization.

18. Based on the previous discussion, the skilled artisan would understand *Jialanella* to be non-analogous art. The skilled artisan interested in improving polymers and polymer mixtures with improved processability and with maintained or improved mechanical properties suitable for e.g. injection molding processes would not try to find solutions in studying polymers used for adhesives and coatings as taught by *Jialanella*. The skilled artisan reading *Jialanella* would be taught to either combine wax with a suitable nucleating agent or then to avoid wax for

at least two reasons: (i) the adverse effect on elongational properties (further explained before) and (ii) *Jialanella's* teaching that the wax should have a greater density than that of the interpolymer. See *Jialanella*, column 2, lines 5-10. A greater density reflects a higher melting point. As a result, the skilled artisan would understand that the processability is aggravated because a higher melting temperature has to be reached.

19. With the claimed polymer mixtures, the opposite was found of what is expected from reading *Jialanella*. The elongational properties were not deteriorated due to addition of wax and processability is improved.

20. The skilled artisan would find no guidance in *Jialanella* to realize the benefit of compatible waxes for injection molding applications of the claimed polymer mixture where, without the use of a nucleating agent and after sufficient mixing when the wax molecules are evenly distributed within the polymer and some essential structural requirements of the polymer and wax are fulfilled, a synergistic interaction of the wax and the polymer takes place upon cooling. This results in a macromolecular network that is created by a kind of crystallization where the resulting crystals are built from the polymer macromolecules as well as the wax molecules such that an improved processability can be combined with improved mechanical properties.

21. Based on the disclosure of *Jialanella*, the skilled artisan would understand that the subject of *Jialanella* is to provide coatings and hot melt adhesives based on interpolymers with increased upper use temperature and increased onset of crystallization that is achieved by using a wax. While these hot melt adhesives have in spite of the highly deleterious effect of the wax particularly good elongational properties (e.g. high elongation at break), which is achieved by a nucleating agent, the skilled artisan would be surprised to find that hot melt adhesives comprising any olefin polymers, a nucleating agent and optionally a tackifier, plasticizer or wax are also a subject of *Jialanella*. See *Jialanella*, column 2, lines 24-29. Nevertheless, *Jialanella* provides no examples concerning such compositions. Rather at column 15, line 50 to column 16, line 8, *Jialanella* describes such compositions by stating that the hot melt adhesives of his

polymer composition may instead or in addition to the homogeneous ethylene polymer (the interpolymer) comprise any of a variety of traditional olefin polymers ranging from LDPE's with densities of $0.910 - 0.935\text{g/cm}^3$ to HDPE's with densities of $0.941 - 0.965\text{g/cm}^3$. The skilled artisan would be surprised that such polymers with a deleterious effect on elongational properties are now useful. Further, the skilled artisan would understand that such polymers are not practical in hot melt compositions because, unlike the wax, they increase the viscosity dramatically such that the hot melts are not liquids anymore.

22. *Baker-Hughes* discloses a polyethylene wax and suggests that it is suitable in the field of polystyrene foams. As the wax and the polystyrene polymer are chemically incompatible, no molecularly dispersed mixture can be obtained and heterocrystallisation is impossible. The skilled artisan would understand that in such mixtures a migration of the wax to the surface of the polymer blend is expected as it is typically (but in most cases undesired) the case for additives that should improve processability. This effect also becomes obvious from the fact that the waxes may be used for mold-release, which is due to a layer of wax at the surface of molded articles. Moreover, the skilled artisan would find that the essential specific requirements of the mixing process of the claimed polymer mixture are not disclosed or suggested by *Baker-Hughes*.

23. *Eastman publication "Epolene E-20 Wax"* teaches a reduced melt flow index ("MFI"), when adding more than 5 % wax. See *Eastman publication "Epolene E-20 Wax"*, Figure 2. In contrast, Figure 4 of the pending application shows that the MFI increases when adding a wax. Moreover, *Eastman publication "Epolene E-20 Wax"* teaches a dramatically reduced elongation of break, when adding a wax. See *Eastman publication "Epolene E-20 Wax"*, Figure 8. According to the pending application, the elongation at break does not decrease when adding a compatible wax under sufficient mixing. Moreover, *Eastman publication "Epolene E-20 Wax"* concerns a wax that is oxidized (page 1, line 1) and therefore is not compatible in accordance with the claimed polymer mixture. Finally, the skilled artisan would find that the essential specific requirements of the mixing process of the claimed polymer mixture are not disclosed or suggested by *Eastman publication "Epolene E-20 Wax"*.

24. For all the foregoing reasons, as one having ordinary skill in the art, I believe that the cited references fail to teach or recognize the criticality of the combination of the specific components of the claimed polymer mixture as recited by independent Claim 13 along with the claims that depend from Claim 13. I believe that there is no guidance in *Jialanella* and *Baker-Hughes* for one of skill in the art to choose the combinations of polymers recited by Claim 13 to achieve the unexpectedly improved processability along with maintained or improved mechanical properties and improved thermal properties in accordance with the present claims. Finally, I believe that *Jialanella* and *Baker-Hughes* lead the skilled person away from finding any advantageous effects with respect to the improved processability along with improved mechanical properties of the claimed polymer mixtures.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, Title 18, United States Code, and that willful false statements may jeopardize the validity of this patent and any patent issuing therefrom.

Date: August 3rd 2009

R. Müller

Name Rolf Müller